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Claims:

1. An apparatus for low-temperature catalytic gasification of a refined biomass fuel, comprising:

a fuel hopper (10) to momentarily receive refined fuel and including a screw feeder (11) to quantitatively supply the fuel, provided at a lower portion thereof;

a catalytic circulating fluidized-bed gasifier (20) provided in the rear of the fuel hopper (10), and including a shutter connected to the screw feeder (11), provided at a middle portion of the gasifier, and a hot air pipe (21) and a steam pipe (22), provided at a lower portion of the gasifier;

a dust collector (30) connected to the catalytic circulating fluidized-bed gasifier (20) via a pipe extending from an upper portion of the catalytic circulating fluidized-bed gasifier (20) to a side wall of an upper portion of the dust collector (30), to collect fly ash;

a catalyst reformer (40) connected to the dust collector (30) via a pipe extending from the upper portion of the dust collector (30) to a lower portion of the catalyst reformer, and including a lower layer of fixed filter adsorbent bed (41) and an upper layer of fluidized catalyst bed (42);

a heat exchanger (50) connected to the catalyst reformer (40) via a pipe extending from the upper central portion of the catalyst reformer (40) to a middle portion of the heat exchanger;

a tar scrubber (60) disposed in the rear of the heat exchanger (50), and including a tar scrubbing chamber (61), a tar-storing bath (62), and a circulation pump (63) for circulating tar; and

a gas-holder (70) disposed in the rear of the tar scrubber (60).

2. The apparatus according to claim 1, wherein the catalytic circulating fluidized-bed gasifier (20) further includes a small cyclone (23) provided in the upper portion thereof.

3. The apparatus according to claim 1, wherein the catalyst reformer (40) further includes a steam sprayer (43) provided at a lower portion of the fixed filter adsorbent bed (41).

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4. The apparatus according to claim 1, wherein the fixed filter adsorbent bed (41) is a cartridge type, and includes an asbestos filter, particles of alkali earth metal oxide, and particles of an alkali metal salt, mixed together.

5. The apparatus according to claim 1, wherein the tar-storing bath (62) communicates with a lower pipe of each of the catalyst reformer (40) and the heat exchanger (50) via tar valves (64) thereof, to collect the generated tar.

6. A method of low-temperature catalytic gasification of a refined biomass fuel, comprising:

a fuel supplying step of supplying a refined mixture including biomass organic waste, coal, and heavy oil to a middle portion of a gasifier using a screw feeder;

a catalytic circulating fluidized-bed gasification step of drying, volatilizing, low-temperature catalytic gasifying, and partially burning the fuel using hot air and superheated steam in the presence of a catalyst;

a collecting step of collecting fly ash in the gas generated in the catalytic circulating fluidized gasification step;

a catalyst reforming step of reforming the gas through a lower layer of fixed adsorbent bed and reforming tar-nitrogen, aromatic-nitrogen, phosphorous and sulfur through an upper layer of fluidized catalyst bed;

a heat exchanging step of cooling the gas to 200°C or less and transferring condensed liquid to a tar-storing bath;

a tar scrubbing step of condensing non-converted tar or non-condensed liquid to be recovered, and gas stripping the condensed liquid; and

a gas-storing step of compressing the gas to be stored temporarily.

7. The method according to claim 6, wherein the catalyst used in the catalytic circulating fluidized-bed gasification step is selected from the group consisting of natural limestone, lime magnesite, caustic lime, an alkali earth metal including calcium, magnesium or barium and oxides thereof, an alkali metal including potassium and oxides thereof, alumina, and mixture thereof, each of which is provided in particles or course powders suitable for fluidization.

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8. The method according to claim 6, wherein the catalytic circulating fluidized-bed gasification step further comprises re-circulating a scattered catalyst or fuel agglomerate to the catalytic circulating fluidized-bed gasifier (20) through a small cyclone (23).

9. The method according to claim 6, wherein the catalyst reforming step further comprises spraying steam onto the lower portion of the fixed adsorbent bed (41) to accelerate reformation and prevent the pipe from clogging, so that a reformation temperature is 650°C or less.

10. The method according to claim 6, wherein the catalyst reforming step comprises converting hydrogen sulfide into CaS and phosphorous into $P_\alpha H_\beta S_\gamma Halogen_\delta$ (α=1-7, β=0-5, γ=0-7, δ=0-7), to be chemically adsorbed into the fixed adsorbent bed (41).

11. The method according to claim 6, wherein the fluidized catalyst of the fluidized catalyst bed (42) used in the catalyst reforming step is a single metal, including Ni, Fe, Co, Mo, Mn, Zr, Ti, Ce, Ru, Rh or Pt, and oxides thereof, or mixtures thereof, which functions to decompose tar by gasification and convert aromatic-nitrogen or HCN into an alkane compound or an alkene compound and NH_3.